CKM, Injector III, and SRF Test Area Heat Loads and Flows

26-Mar-02

Total (Dynamic plus Static) Heat Loads (1.8 K)				Vapor flow (g/s)		Comments
CKM Station 1	**75 K - 85 K**	**4.5 K**	**1.8 K**	80 K	5 K	For 15 MV/sta, 8 cav (4m) gives 3.75 MV/m, while 6 cav (3m) gives 5 MV/m.8 offers redundancy.
Warm to Cold Transition (W)	13.0	0.0	1.6			from LHC beam tube transition estimates
Four 2-cavity modules total (W)	158.4	8.0	30.0			
Supports and thermal radiation (W/m)	34.0	2.0	5.0			Scaled from SNS numbers
Dynamic RF heating (W/m)	0.0	0.0	2.1			From EES at 1.8 K surf, 5 MV/m deflection. Only 1.2 W/m if 3.75 MV/m.
Effective length of station (m)	4.0	4.0	4.0			One 13 cell cav has Lrf=0.5 m so x 8 cav=4m. Not 3m
Input couplers (W)	22.4	0.0	1.6			
HOM couplers (W)	0.0	0.0	0.0			Guesses or space fillers in red
Feed box (W)	150.0	20.0	5.0	0.0	0.0	Heat scaled from MTF Stand 4
Warm to Cold Transition (W)	13.0	0.0	1.6			
TOTAL HEAT LOAD	334.4	28.0	38.2	0.0	0.0	
Helium flow rate (g/s)	7.1	1.6	1.9			See flow summary sheet for explanation

CKM Station 2	**75 K - 85 K**	**4.5 K**	**1.8 K**	80 K	5 K	Same as Station 1
Warm to Cold Transition	13.0	0.0	1.6			
Four 2-cavity modules total (W)	158.4	8.0	30.0			
Supports and thermal radiation (W/m)	34.0	2.0	5.0			
Dynamic RF heating (W/m)	0.0	0.0	2.1			
Effective length of station (m)	4.0	4.0	4.0			
Input couplers (W)	22.4	0.0	1.6			
HOM couplers (W)	0.0	0.0	0.0			
Feed box (W)	150.0	20.0	5.0	0.0	0.0	Heat scaled from MTF Stand 4
Warm to Cold Transition	13.0	0.0	1.6			
TOTAL HEAT LOAD	334.4	28.0	38.2	0.0	0.0	
Helium flow rate (g/s)	7.1	1.6	1.9			

TTF Module 1	**75 K - 85 K**	**4.5 K**	**1.8 K**	80 K	5 K	Consider surf at 1.8 K
Warm to Cold Transition (W)	13.0	0.0	1.6			
One 8-cavity TTF cryomodule (W)	175.0	27.3	14.0			From John Weisend's presentation
Supports and thermal radiation (W)	90.0	23.0	6.0			from EES model which produced Dsgn Rport 2K conditions.
Dynamic heating (W)	85.0	4.3	8.0			Has lower Q (5e9), takes Rres=35nOhm
						so residual effects significant for lower Q cavities.
Feed box (W)	150.0	20.0	5.0	0.0	0.1	Four pair of 100 A leads totaling 0.1 g/s per TTF Design Rept
Warm to Cold Transition (W)	13.0	0.0	1.6			
TOTAL HEAT LOAD	351.0	47.3	22.2	0.0	0.1	
Helium flow rate (g/s)	7.5	2.6	1.1			

TTF Module 2	**75 K - 85 K**	**4.5 K**	**1.8 K**	80 K	5 K	Same as module 1
Warm to Cold Transition (W)	13.0	0.0	1.6			
One 8-cavity TTF cryomodule (W)	175.0	27.3	14.0			
Supports and thermal radiation (W)	90.0	23.0	6.0			
Dynamic heating (W)	85.0	4.3	8.0			

Feed box (W)	150.0	20.0	5.0	0.0	0.1	Four pair of 100 A leads totaling 0.1 g/s per TTF Design Rept
Warm to Cold Transition (W)	13.0	0.0	1.6			
TOTAL HEAT LOAD	351.0	47.3	22.2	0.0	0.1	
Helium flow rate (g/s)	7.5	2.6	1.1			

TTF 3rd Harmonic Module	**75 K - 85 K**	**4.5 K**	**1.8 K**	80 K	5 K	Same as module 1
Warm to Cold Transition (W)	13.0	0.0	1.6			Use same warm to cold transition
One 3.9 GHz cryomodule (W)	42.5	2.4	6.0			
Supports and thermal radiation (W)	34.0	2.0	5.0			Take one meter of CKM static loads
Dynamic heating (W)	8.5	0.4	1.0			Take one tenth of TESLA module
Feed box (W)	50.0	7.0	1.0	0.0	0.1	Take about 1/3 of other feedboxes
Warm to Cold Transition (W)	13.0	0.0	1.6			
TOTAL HEAT LOAD	118.5	9.4	10.2	0.0	0.1	
Helium flow rate (g/s)	2.5	0.5	0.5			

Vertical Test Dewar	**75 K - 85 K**	**4.5 K**	**2.0 K**	Estimated based on MTF vertical dewar
TOTAL HEAT LOAD	180.0	0.0	20.0	Neglecting dynamic heating of test cavity
Helium flow rate (g/s)	3.8	0.0	1.0	

Horizontal Test Dewar (Optional)	**75 K - 85 K**	**4.5 K**	**2.0 K**	Estimated based on horizontal test stands at MTF including end effects
TOTAL HEAT LOAD	200.0	20.0	10.0	Neglecting dynamic heating of test cavity
Helium flow rate (g/s)	4.3	1.1	0.5	

Transfer lines and junction boxes	**75 K - 85 K**	**4.5 K**	**2.0 K**	~10"dia outer pipe, 4.5" inner 2K return.
CKM Transfer line length [m]	125	125	125	about same for either KTEV or MP9
TTF Transfer line length [m]	375	375	375	Worst case, at PC4. 281m if at LabE
TL Supports and thermal radiation (W/m)	0.38	0.015	0.004	Scaled from Tev TL pipe Qto4K=0.011 W/m and Qto80K=0.19 W/m
CKM Expansion box/anchor [number]	4	4	4	Worst case, at KTEV. 3 if at MP9.
TTF Expansion box/anchor [number]	6	6	6	Worst case, at PC4. 3 if at LabE.
Exp Box Suppts and thermal rad (W/unit)	80	6.6	0.1	Scaled from Tev
TOTAL HEAT LOAD	990.0	73.5	3.0	
Helium flow rate (g/s)	21.2	4.1	0.2	